

## ARCADIS Avantic

**SP**

### Quality Assurance

System

Image Quality Quick Test for Software Version  
VC10A and later

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## Notes and symbols



The signal words are used and classified in anticipation of the new Medical Solutions CS standard which is based on ANSI standard Z535.4.

**Emphasized text in this technical documentation has the following meanings:**



Tab. 1 GEFAHR / DANGER

|   |  |
|---|--|
|  <b>GEFAHR</b> | Bei einer unmittelbar drohenden Gefahr, die bei Nichtvermeidung zum Tod oder zu einer schweren Körperverletzung <b>führt</b> . |
|  <b>DANGER</b> | Indicates when there is an immediate danger that <b>leads</b> to death or serious physical injury.                             |

Tab. 2 WARNUNG / WARNING

|   |  |
|---|--|
|  <b>WARNUNG</b>  | Bei einer Gefahr, die bei Nichtvermeidung zum Tod oder zu einer schweren Körperverletzung <b>führen kann</b> . |
|  <b>WARNING</b> | Indicates a risk of danger that <b>may lead</b> to death or serious physical injury.                           |

Tab. 3 VORSICHT / CAUTION

|   |   |
|---|---|
|  <b>VORSICHT</b> | Bei einer Gefahr, die bei Nichtvermeidung zu einer leichten oder mittleren Körperverletzung und/ oder zu einer Sachbeschädigung <b>führt oder führen kann</b> . |
|  <b>CAUTION</b>  | Indicates a risk of danger that leads to slight or moderate physical injury and/or damage to property.  |

Tab. 4 ACHTUNG / NOTICE

|                |   |
|----------------|---|
| <b>ACHTUNG</b> | Bei einer Gefahr, die bei Nichtvermeidung zu einem unerwünschten Ergebnis oder Zustand <b>führt oder führen kann (nicht Tod, Körperverletzung oder Sachbeschädigung)</b> .                            |
| <b>NOTICE</b>  | Indicates a risk of danger that if disregarded leads or may lead to a potential situation which may result in an undesirable result or state ( <b>not</b> death, physical injury or property damage). |



Tab. 5 HINWEIS / NOTE

|                |   |
|----------------|---|
| <b>HINWEIS</b> | Ist als Tipp zu verstehen. Der Anwender muss diese Anweisung nicht unbedingt beachten. Er erfährt jedoch Vorteile, wenn er dies tut.          |
| <b>NOTE</b>    | Should be understood as a tip. The user does not absolutely have to observe these instructions. However, there will be advantages if he does. |



## General safety information (in existing documents)



**Danger of injury, death, or material damage.**

**Non-compliance can lead to death, injury, or material damage.**

**Please note:**

- ⇒ **The product-specific safety information in the start-up instructions and system service documentation,**
- ⇒ **The general safety information in TD00-000.860.01, and**
- ⇒ **The safety information in accordance with ARTD Part 2.**



## System identification

|                                      |                       |
|--------------------------------------|-----------------------|
| Material no.: _____                  | Serial no.: _____     |
| Customer/clinic: _____               |                       |
| Address: _____                       | City: _____           |
| State/province: _____ Country: _____ |                       |
| Phone no.: _____                     | Contact person: _____ |
| System no.: _____                    | Office: _____         |
| Responsible system engineer: _____   |                       |

**Image quality acceptance in the factory performed completely and documented by:**

Name (block letters): \_\_\_\_\_ Dept: \_\_\_\_\_  
 Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Customer installation date: \_\_\_\_\_

IQ quick test performed at:

Handover to customer ☐ During maintenance ☐

**Settings deviating from the standard based on:**

Country-specific Regulations ☐ Spec. customer wishes ☐

Reason: \_\_\_\_\_

Name (block letters): \_\_\_\_\_ Office: \_\_\_\_\_

Signature: \_\_\_\_\_



## Required measuring equipment and tools

- Set of X-ray filters, 10 x 0.3 mm Cu 44 06 120 RV090
- Precision X-ray filter, 2.1 mm Cu 99 00 598 XE999
- 25 mm AL measuring stand, type 26765 acc. to DIN 6868 Part 50
- or 97 98 596 G5321 and
- 1.2 mm Cu from the X-ray filter set 11 67 662 G5247
- 17 µm Cu strips
- Resolution test set type 41 28 71 820 RE999
- Densitometer e.g. X-Rite 331 97 02 416 Y1996
- or PTW-BC21 including black check
- Type 5321 and light box type 53213
- Dynamic test case 37 90 156 X1963
- or 97 50 001 X1963
- containing: TV dynamic test 37 90 164 X1963
- Heart contour diaphragm 37 90 172 X1963
- Capillary test 37 90 180 X1963
- Mount 87 13 901 X1963
- Veiling glare test 87 09 743 X1963
- SMfit Spotmeter 77 52 848



## Requirements

### Basic measuring conditions

- Completely functioning system; ensure that
  - the grid is attached to the I.I. input.
  - the cover is attached to the POWERPHOS over the tube collimator.
- A "mid" level fluoro dose rate means: (full format; setting tolerance 10%).

33 cm I.I.:                      0,131  $\mu\text{Gy/s}$  - fluoro (at the I.I. input), grid factor 1.5 must be used.

- A "high" level fluoro dose rate means: (full format; setting tolerance 10%).

33 cm I.I.:                      0,262  $\mu\text{Gy/s}$  - fluoro (at the I.I. input), grid factor 1.5 must be used.

- In addition, dose multipliers predefined in the unit are used for the different operating modes.
- The setpoints listed in the following chapters apply for a "mid" or "high" dose level; in the case of deviating settings, setpoints may have to be adapted.
- When requested to switch
  - Noise reduction K-factor
  - Edge
  - Motion detection
  - Fluoroscopic characteristic
  - or other parameters in the organ programs, select or change a correspondingly pre-defined organ program or, if possible, change the parameter directly in the acquisition task card.
- The "Service\_X\_..." exam sets in "General, All Body Region" must be activated in the ExamSet Editor prior to starting work and returned to the hidden pool after completion of the work. See the following paragraph "Loading/unloading the exam sets relevant for the IQ test."



## Activating, deactivating, and selecting the exam sets relevant for the IQ test

**NOTE**

Exam sets relevant for the IQ test have been predefined to simplify image quality testing and can be loaded.

During normal operation, these are not active and are not visible to the customer.

The exam sets relevant for the IQ test must be activated prior to conducting the image quality test.

These exam sets must then be deactivated after completion of the IQ test.

### Activating the exam sets relevant for the IQ test

- Select the "Options" - "Configuration" menu after system start-up.
  - ⇒ The "syngo configuration panel" window is displayed.
- Double-click on the "Examination set configuration" icon.
  - ⇒ The "Examination set configuration" window is displayed.
- Select the "General" task card in the "Examination set configuration" window.

**NOTE**

For the exam sets relevant for the IQ test to be visible, no patient region may be selected in the graphic, virtual patient anatomy representation.

If a patient region is selected and is displayed lighter than its surroundings, click once in the gray field to the left or right outside of the image.

This deselects the previously selected patient region so it is no longer displayed lighter than its surroundings.

- All available exam sets are displayed in the "Examination set pool" field in the "Examination set configuration" window.
  - ⇒ Already active exam sets have a light background.
  - ⇒ Inactive exam sets have a gray background.
- Select each exam set beginning with "SERVICE\_...." and copy it to the "Active examination sets" field by clicking on the button with the down arrow.
  - ⇒ All exam sets beginning with "SERVICE\_..." are displayed in the "Active examination sets" field.
- Click on the "Apply" button.
- Click on the "OK" button.
  - ⇒ The "Examination set configuration" window closes.
  - ⇒ The exam sets relevant for the IQ test can be selected in the examination task card after a patient is opened under "General."



### Deactivating the exam sets relevant for the IQ test

- Select the "Options" - "Configuration" menu after system start-up.
  - ⇒ The "syngo configuration panel" window is displayed.
- Double-click on the "Examination set configuration" icon.
  - ⇒ The "Examination set configuration" window is displayed.
- Select the "General" task card in the "Examination set configuration" window.

#### NOTE

**For the exam sets relevant for the IQ test to be visible, no patient region may be selected in the graphic, virtual patient anatomy representation.**

**If a patient region is selected and is displayed lighter than its surroundings, click once in the gray field to the left or right outside of the image.**

**This deselects the previously selected patient region so it is no longer displayed lighter than its surroundings.**

- All available exam sets are displayed in the "Active examination sets" field in the "Examination set configuration" window. Active exam sets have a light background.
- Select each exam set beginning with "SERVICE\_...." and remove them from the "Active examination sets" field by clicking on the button with the up arrow.
  - ⇒ None of the exam sets beginning with "SERVICE\_..." are displayed any longer in the "Active examination sets" field.
- Click on the "Apply" button.
- Click on the "OK" button.
  - ⇒ The "Examination set configuration" window closes.
  - ⇒ The exam sets relevant for the IQ test are no longer available in the examination task card after a patient is opened under "General."

### Selecting the exam sets relevant for the IQ test in the examination task card

- After system start-up, perform a patient registration for the IQ test.
- After loading, the exam sets relevant for the IQ test can be selected in the examination task card.
- Select "General" in the list field above the graphic, virtual patient anatomy representation.
- The exam sets relevant for the IQ test (beginning with "SERVICE\_....") can then be selected in the list field below the graphic, virtual patient anatomy representation.

## Loading the ASPIA test images relevant for the IQ test

#### NOTE

**The ASPIA test images relevant for the IQ test are not selectable during normal system operation.**

**To load the images, the local service must be open.**



- Select local service on the system (menu: "Options" - "Service" - "Local service") and enter the password.
- Leave the local service open during use of the necessary test images.
- Open the patient browser.
  - ⇒ The available test images are saved and retrievable under the following path:  
"Patient" - "Patient list" - "Local database" - "Service patient" - "Test images."
- If the test images are no longer needed, close the open test images and terminate the local service.



## Avantic tableside control (overview)

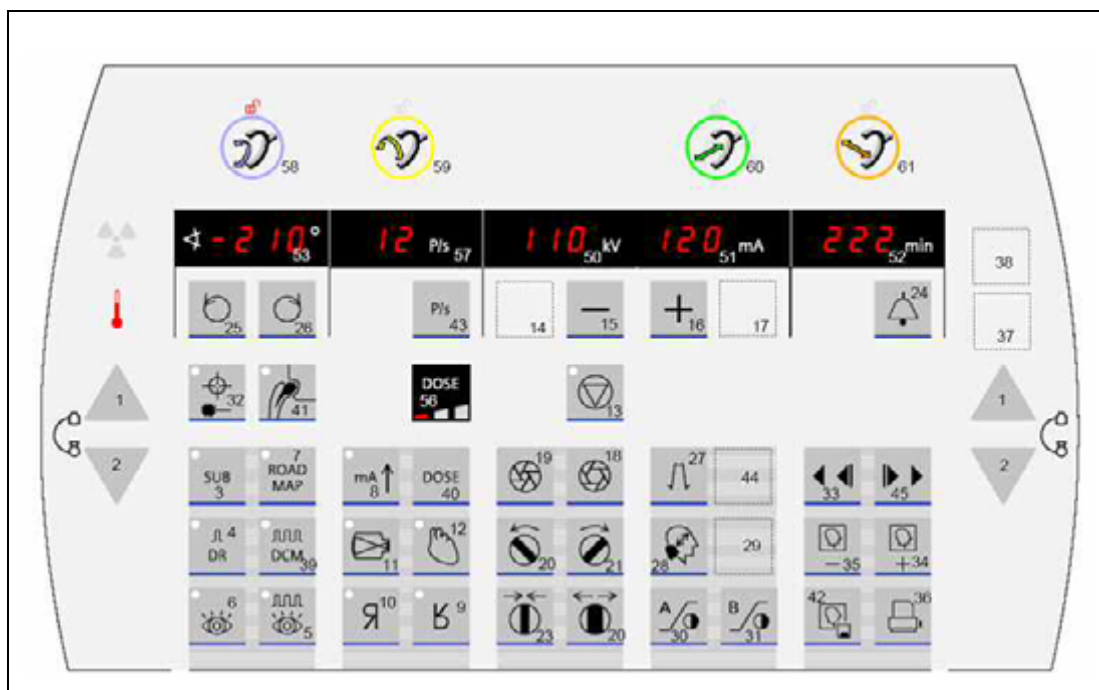


Fig. 1: Overview of button assignment on the control panel

### Control panel buttons:



| Key no. | Function                                      |
|---------|---|
| 1       | Move each column up two times                 |
| 2       | Move each column down two times               |
| 3       | Subtraction mode "SUB"                        |
| 4       | Digital radiography mode "DR"                 |
| 5       | Pulsed fluoroscopy mode "pulsed FLUORO"       |
| 6       | Fluoroscopy mode "FLUORO"                     |
| 7       | Roadmap mode                                  |
| 8       | Push button                                   |
| 9       | Image rotation top/bottom (vertical)          |
| 10      | Image rotation left/right (horizontal)        |
| 11      | Image intensifier zoom                        |
| 12      | Noise reduction (K-factor selection)          |
| 13      | kV - Control stop                             |
| 14      | Reserve 1                                     |
| 15      | kV/mA adjustment (-)                          |
| 16      | kV/mA adjustment (+)                          |
| 17      | Reserve 2                                     |
| 18      | Open X iris diaphragm                         |
| 19      | Close X iris diaphragm                        |
| 20      | Rotate filter diaphragms CCW                  |
| 21      | Rotate filter diaphragms CW                   |
| 22      | Open filter diaphragm                         |
| 23      | Close filter diaphragm                        |
| 24      | Reset fluoro buzzer; set fluoro clock to zero |
| 25      | Image cursor left                             |
| 26      | Image cursor right                            |
| 27      | Edge enhancement                              |
| 28      | Electronic zoom in the memory                 |
| 29      | Reserve 3                                     |
| 30      | Look-up table for Monitor A                   |
| 31      | Look-up table for Monitor B                   |



|    |                                     |
|----|-------------------------------------|
| 32 | Laser                               |
| 33 | Scene backward/stop                 |
| 34 | Scroll forward in the image memory  |
| 35 | Scroll backward in the image memory |
| 36 | Initiate the documentation unit     |
| 37 | n/a                                 |
| 38 | n/a                                 |
| 39 | DCM mode                            |
| 40 | Dose button                         |
| 41 | Metal button                        |
| 42 | Saving an image                     |
| 43 | Pulses per second                   |
| 44 | Reserve 4                           |
| 45 | Scene forward/stop                  |

#### **Brake control buttons**

| <b>No.</b> | <b>Function</b>        |
|------------|------------------------|
| 58         | Orbital C-arm brake    |
| 59         | Angular C-arm brake    |
| 60         | Horizontal C-arm brake |
| 61         | Swivel C-arm brake     |



## Monitors present

- Mark the monitor (color or monochrome monitor) present.
- Enter the monitor model and manufacturer in the "Model / Manufacturer" field as indicated on the model plate.

### Color monitors ☐ present

|                      |              |
|----------------------|--------------|
| Model / manufacturer | ...../ ..... |
|----------------------|--------------|

### Monochrome monitors ☐ present

|                      |              |
|----------------------|--------------|
| Model / manufacturer | ...../ ..... |
|----------------------|--------------|



## Monitor brightness

- Open local service so that the service patient is displayed in the Patient Browser.
- Load the SMPTE calibration test image.
- Measure the 100% bright field with the SMfit spotmeter.

|             |
|-------------|
| <b>NOTE</b> |
|-------------|

**Do not exert any pressure on the LCD display of the monitor during the measurement with the SMfit spotmeter.**

- Switch off the ambient light sensor, if present.

## Color monitors

|   | <b>Luminance setpoint:</b>   | <b>Factory<br/>Measured luminance:</b> | <b>Place of use<br/>Measured luminance:</b> |
|---|------------------------------|--|---|
| <b>Left monitor<br/>100% bright<br/>field</b>   | 200 cd/m2<br>+/- 20 cd/m2 *1 | ..... cd/m2                            | ..... cd/m2                                 |
| <b>Right monitor<br/>100% bright<br/>field</b>  | 200 cd/m2<br>+/- 20 cd/m2 *1 | ..... cd/m2                            | ..... cd/m2                                 |
| *1 Tolerance specifications in the delivery state.<br>The monitor is worn out when the maximum adjustable luminance has fallen below 120 cd/m2. |                              |  |   |
| Remarks: .....  |                              |  |   |

## Monochrome monitors

|   | <b>Luminance setpoint:</b>   | <b>Factory<br/>Measured luminance:</b> | <b>Place of use<br/>Measured luminance:</b> |
|---|------------------------------|--|---|
| <b>Left monitor<br/>100% bright<br/>field</b>   | 400 cd/m2<br>+/- 20 cd/m2 *1 | ..... cd/m2                            | ..... cd/m2                                 |
| <b>Right monitor<br/>100% bright<br/>field</b>  | 400 cd/m2<br>+/- 20 cd/m2 *1 | ..... cd/m2                            | ..... cd/m2                                 |
| *1 Tolerance specifications in the delivery state.<br>The monitor is worn out when the maximum adjustable luminance has fallen below 350 cd/m2. |                              |  |   |
| Remarks: .....  |                              |  |   |



## Monitor contrast

- Load the SMPTE calibration test image.
- Switch off the ambient light sensor of the monitor, if present.
- Measure the 0% dark field with the SMfit spotmeter.

**NOTE**

**Do not exert any pressure on the LCD display of the monitor during the measurement with the SMfit spotmeter.**

- Use the luminance measured previously in the "Monitor brightness" section in the 100% bright field to calculate the contrast.
- Calculate the contrast as follows and enter it in the table:

$$\text{Contrast} = \frac{\text{Monitor, measured luminance in 100\% bright field}}{\text{Monitor, measured luminance in 0\% dark field}} \text{ (divided by)}$$

## Color monitors

|  | Setpoints                           | Factory                                | Place of use                           |
|--|-------------------------------------|--|--|
| <b>Left monitor</b><br><b>0% dark field</b>  | Luminance setpoint:<br><br>≤1 cd/m2 | Measured luminance:<br><br>..... cd/m2 | Measured luminance:<br><br>..... cd/m2 |
| <b>Left monitor</b><br><b>Contrast</b>       | Contrast setpoint:<br><br>≥ 200     | Calculated contrast:<br><br>.....      | Calculated contrast:<br><br>.....      |
| <b>Right monitor</b><br><b>0% dark field</b> | Luminance setpoint:<br><br>≤1 cd/m2 | Measured luminance:<br><br>..... cd/m2 | Measured luminance:<br><br>..... cd/m2 |
| <b>Right monitor</b><br><b>Contrast</b>      | Contrast setpoint:<br><br>≥ 200     | Calculated contrast:<br><br>.....      | Calculated contrast:<br><br>.....      |



### Monochrome monitors

|  | Setpoints                                       | Factory  | Place of use                                       |
|--|---|--|--|
| <b>Left monitor</b><br><b>0% dark field</b>  | Luminance setpoint:<br><br>≤1 cd/m <sup>2</sup> | Measured luminance:<br><br>..... cd/m <sup>2</sup> | Measured luminance:<br><br>..... cd/m <sup>2</sup> |
| <b>Left monitor</b><br><b>Contrast</b>       | Contrast setpoint:<br><br>≥ 350                 | Calculated contrast:<br><br>.....                  | Calculated contrast:<br><br>.....                  |
| <b>Right monitor</b><br><b>0% dark field</b> | Luminance setpoint:<br><br>≤1 cd/m <sup>2</sup> | Measured luminance:<br><br>..... cd/m <sup>2</sup> | Measured luminance:<br><br>..... cd/m <sup>2</sup> |
| <b>Right monitor</b><br><b>Contrast</b>      | Contrast setpoint:<br><br>≥ 350                 | Calculated contrast:<br><br>.....                  | Calculated contrast:<br><br>.....                  |

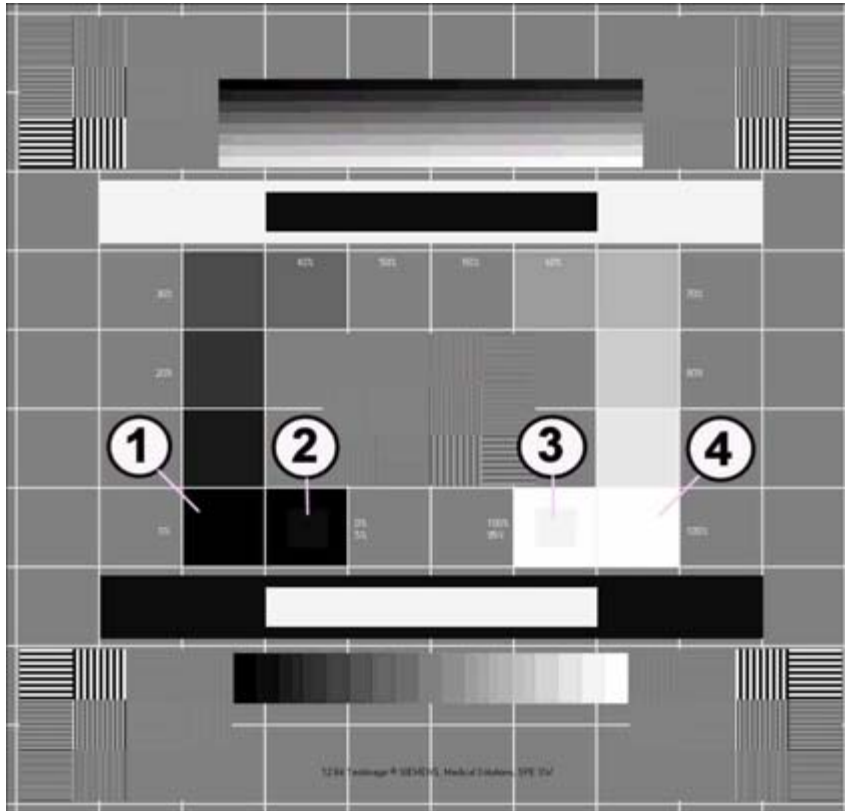
### Visual evaluation of the SMPTE calibration test image

- Display the SMPTE calibration test image on both monitors.
- Visually evaluate the SMPTE calibration test image on both monitors.

| Factory                                     | Left monitor   | Right monitor  |
|---|--|--|
| All gray values are clearly visible:        | <input type="checkbox"/> Yes / <input type="checkbox"/> No | <input type="checkbox"/> Yes / <input type="checkbox"/> No |
| The 5% field and the 95% field are visible: | <input type="checkbox"/> Yes / <input type="checkbox"/> No | <input type="checkbox"/> Yes / <input type="checkbox"/> No |

| Place of use                                | Left monitor   | Right monitor  |
|---|--|--|
| All gray values are clearly visible:        | <input type="checkbox"/> Yes / <input type="checkbox"/> No | <input type="checkbox"/> Yes / <input type="checkbox"/> No |
| The 5% field and the 95% field are visible: | <input type="checkbox"/> Yes / <input type="checkbox"/> No | <input type="checkbox"/> Yes / <input type="checkbox"/> No |





*Fig. 2: SMPTE calibration test image*

|        |            |
|--------|------------|
| Pos. 1 | 0% field   |
| Pos. 2 | 5% field   |
| Pos. 3 | 95% field  |
| Pos. 4 | 100% field |

**Close local service.**

- Close Local Service again, otherwise the measurement field is displayed and, as a result, influences the image for the subsequent checks.



## Requirements

- The indicated exam sets must be selected for fluoroscopy, pulsed fluoroscopy, DCM, and DR. See the "Loading the exam sets relevant for the IQ test" section.
- Attach a 2.1 mm Cu precision X-ray filter for prefiltering in the area of the radiation exit.
- All exposures are pre-contrast images (no additional object in the beam path).

## Evaluation

|             |
|-------------|
| <b>NOTE</b> |
|-------------|

---

**The specified exam sets must be used for the checks.**

**The activation of the exam sets is described in the introduction chapter.**

---



## ADR control curve for the fluoroscopy mode



- Select fluoro.
- Select I.I. full format.
- Select the "General, All region, SERVICE\_Q\_S2" exam set.
- Select medium dose level.
- Radiation on.
- Read off the kV and mA values displayed on the operating panel.
- Radiation off.
- Record the values in Tab. 1, Line S2.
- Fluoro and I.I. full format remain selected.



- Select the "General, All region, SERVICE\_Q\_C\_HC2" exam set.
- Select medium dose level.
- Radiation on.
- Read off the kV and mA values displayed on the operating panel.
- Radiation off.
- Record the values in Tab. 1, Line HC2.
- The actual values documented at the factory must be obtained again at the place of use. Admissible deviations: Tube voltage (kV)  $\pm 1$  kV, tube current (mA)  $\pm 10\%$ .

Tab. 6

| Cont. fluoro<br>ADR control curves (included in<br>the exam set) | Setpoints |           | Actual values |    |              |    |
|--|-----------|-----------|---------------|----|--------------|----|
|  |           |           | Factory       |    | Place of use |    |
|  | kV        | mA        | kV            | mA | kV           | mA |
| S2<br>(General, All region,<br>SERVICE_Q_S2, Mid Dose)           | 66 - 72   | 1,0 - 1,2 |               |    |              |    |
| HC 2<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid Dose)      | 62 - 64   | 2,5 - 3,7 |               |    |              |    |



## ADR control curves for the pulsed fluoroscopy mode

- Select pulsed fluoro.
- Select I.I. full format.
- Select the "General, All region, SERVICE\_Q\_S2" exam set.
- Select medium dose level.
- Pulse frequency 8 (7.5) pulses per second
- Radiation on.
- Read off the kV and mA values displayed on the monitor.
- Radiation off.
- Record the values in Tab. 2, Line S2/8 Fps.
- Pulsed fluoro and I.I. full format remain selected.
- Select the "General, All region, SERVICE\_Q\_C\_HC2" exam set.



- Select medium dose level.
- Radiation on.
- Read off the kV and mA values displayed on the monitor.
- Radiation off.
- Record the values in Tab. 2, Line HC2/8 Fps.
- The actual values documented at the factory must be obtained again at the place of use. Admissible deviations: Tube voltage (kV)  $\pm 1$  kV, tube current (mA)  $\pm 10\%$ .



Tab. 7

| Pulsed fluoro<br>ADR control curves<br>(included in the exam set)   | Setpoints |             | Actual values |    |              |    |
|---|-----------|-------------|---------------|----|--------------|----|
|   |           |             | Factory       |    | Place of use |    |
|   | kV        | mA          | kV            | mA | kV           | mA |
| S2/8 Fps<br>(General, All region,<br>SERVICE_Q_S2, Mid Dose)        | 64 - 70   | 14,3 - 18,6 |               |    |              |    |
| HC2/8 Fps<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid<br>Dose) | 60 - 63   | 36,0 - 56,3 |               |    |              |    |



## ADR control curve for the DCM mode

|  |     |    |
|--|-----|----|
| DCM option present:<br>If no: The "ADR control curve for the DCM mode" section does not apply. | Yes | No |
|--|-----|----|



- Select DCM.
- Select I.I. full format.
- Select the "General, All region, SERVICE\_Res\_HC2" exam set.
- Pulse frequency 8 (7.5) pulses per second
- Select high dose level.
- Radiation on.
- Read off the kV and mA values displayed on the monitor.
- Radiation off.
- Record the values in Tab. 2, Line HC2/8 Fps.
- The actual values documented at the factory must be obtained again at the place of use. Admissible deviations: Tube voltage (kV)  $\pm 1$  kV, tube current (mA)  $\pm 10\%$ .

Tab. 8

| DCM<br>ADR control curve<br>(included in the exam set)               | Setpoints |           | Actual values |    |              |    |
|--|-----------|-----------|---------------|----|--------------|----|
|  |           |           | Factory       |    | Place of use |    |
|  | kV        | mA        | kV            | mA | kV           | mA |
| HC2/8 Fps<br>(General, All region,<br>SERVICE_Q_C_HC2, High<br>Dose) | 65 - 69   | 173 - 250 |               |    |              |    |



## ADR control curves for the DR mode



- Select DR.
- Select I.I. full format.
- Select the "General, All region, SERVICE\_Q\_C\_HC2" exam set.
- Select medium dose level.
- Radiation on.
- Read off the kV and mAs values displayed on the monitor.
- Radiation off.
- Record the values in Tab. 3, Line DR 1000W.
- The actual values documented at the factory must be obtained again at the place of use. Admissible deviations: Tube voltage (kV)  $\pm 1$  kV, Tube current (mA)  $\pm 10\%$ .

Tab. 9

| DR takeover  | Setpoints |           | Actual values |     |              |     |
|--|-----------|-----------|---------------|-----|--------------|-----|
|  |           |           | Factory       |     | Place of use |     |
|  | kV        | mAs       | kV            | mAs | kV           | mAs |
| DR 1000W<br>K=16<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid<br>Dose) | 62 - 65   | 4,2 - 6,8 |               |     |              |     |



## Checking the image position

### Requirements

Place a long, thin, straight object (e.g. wire solder bent straight) near the I.I. -- at an exact right angle to the C-arm orientation.

Place a second object next to it -- for direction determination (see [\(Fig. 3 / p. 27\)](#)).



*Fig. 3: Image position*

Pos. 1 C\_arm\_alignment

The rotation angle of the image on the display of the basic unit must be 0.

If necessary, set the angle to 0.



Record an image (see [\(Fig. 4 / p. 28\)](#)).



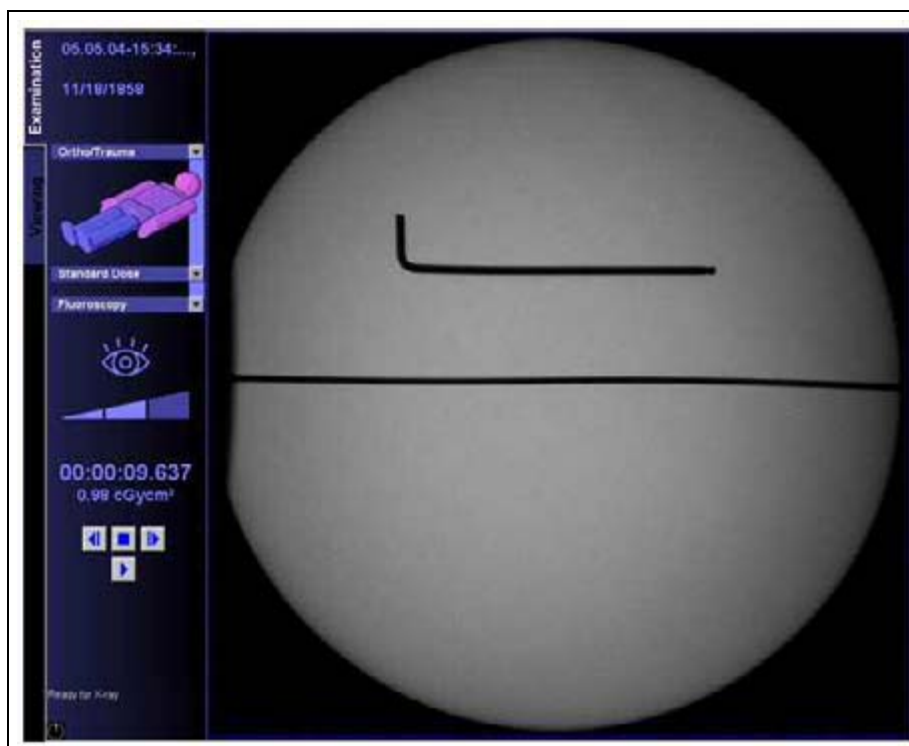


Fig. 4: Results image

## Evaluation

The object must appear on the screen in an exactly horizontal position.

|                    | Factory                  |     |                          |    | Place of use             |     |                          |    |
|--------------------|--------------------------|-----|--------------------------|----|--------------------------|-----|--------------------------|----|
| Image position OK? | <input type="checkbox"/> | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Yes | <input type="checkbox"/> | No |



## Checking the resolution and minimum contrast

### Requirements

- Use resolution test type 41 (factory and place of use).
- Attach the resolution test directly to the I.I. grid in the center of the I.I. at an angle of approx. 90 degrees with respect to the grid lines (45 degrees with respect to the CCD structure).
- In the factory: Place a 25 mm AL measuring stand on the I.I.
- Place of use: If the 25 mm AL measuring stand (with 0.4 mm recess) is present, attach it near the I.I., otherwise attach the 17  $\mu$ m Cu strip directly to the I.I. grid next to the resolution test. Additionally, place a 1.2 mm Cu filter in the beam path. Fading at the I.I. edge can be eliminated via collimation.
- Select the indicated operating mode (fluoro/DCM/DR (1000W)) and the respective I.I. format according to the "Resolution" table.
- Additionally, select the indicated exam set after selecting the appropriate operating mode (fluoro/DCM/DR (1000W)).
- Radiation on.
- Show the resolution test phantom.
- Set the monitor contrast to optimum resolution.
- Set the edge enhancement to optimum resolution.
- Radiation OFF.





## Evaluation of resolution and minimum contrast

|   |     |    |
|---|-----|----|
| DCM option present:   | Yes | No |
| If no: Checking the resolution and minimum contrast during DCM mode does not apply. |     |    |

- Determine the resolution of the LIH image and enter it in the Resolution table.

**NOTE**

**Use the electronic zoom function and windowing in the Viewing task card if necessary.**

Tab. 10 Resolution

| Operating mode<br>(Exam set)  | I.I. format | I.I. 33 setpoints<br>for resolution | Actual resolution values<br>[LP/mm] |                 |
|---|-------------|-------------------------------------|-------------------------------------|-----------------|
|   |             |                                     | Factory                             | Place of<br>use |
| DL (HC2)<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid<br>Dose)  | Full format | $\geq 1.4$ LP/mm                    |                                     |                 |
| DL (HC2)<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid<br>Dose)  | Zoom 1      | $\geq 1.8$ LP/mm                    |                                     |                 |
| DL (HC2)<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid<br>Dose)  | Zoom 2      | $\geq 2.2$ LP/mm                    |                                     |                 |
| DL (HC2)<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid<br>Dose)  | Zoom 3      | $\geq 2.5$ LP/mm                    |                                     |                 |
| DCM (HC2)<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid<br>Dose) | Full format | $\geq 1.2$ LP/mm                    |                                     |                 |
| DCM (HC2)<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid<br>Dose) | Zoom 1      | $\geq 1.6$ LP/mm                    |                                     |                 |



| Operating mode<br>(Exam set)   | I.I. format | I.I. 33 setpoints<br>for resolution | Actual resolution values<br>[LP/mm] |                 |
|--|-------------|-------------------------------------|-------------------------------------|-----------------|
|  |             |                                     | Factory                             | Place of<br>use |
| DCM (HC2)<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid<br>Dose)  | Zoom 2      | $\geq 2.0$ LP/mm                    |                                     |                 |
| DCM (HC2)<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid<br>Dose)  | Zoom 3      | $\geq 2.2$ LP/mm                    |                                     |                 |
| DR (1000W)<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid<br>Dose) | Full format | $\geq 1.4$ LP/mm                    |                                     |                 |
| DR (1000W)<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid<br>Dose) | Zoom 1      | $\geq 1.8$ LP/mm                    |                                     |                 |
| DR (1000W)<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid<br>Dose) | Zoom 2      | $\geq 2.2$ LP/mm                    |                                     |                 |
| DR (1000W)<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid<br>Dose) | Zoom 3      | $\geq 2.5$ LP/mm                    |                                     |                 |

- Also check the minimum contrast during the resolution test and enter it in the minimum contrast table.

Is the minimum contrast visible?

Tab. 11 Minimum contrast

| Factory     |  |     |  |    | Place of use |  |     |  |    |
|-------------|--|-----|--|----|--------------|--|-----|--|----|
| Full format |  | Yes |  | No | Full format  |  | Yes |  | No |
| Zoom 1      |  | Yes |  | No | Zoom 1       |  | Yes |  | No |



|        |  |     |  |    |        |  |     |  |    |
|--------|--|-----|--|----|--------|--|-----|--|----|
| Zoom 2 |  | Yes |  | No | Zoom 2 |  | Yes |  | No |
| Zoom 3 |  | Yes |  | No | Zoom 3 |  | Yes |  | No |

### Evaluation of resolution without prefiltering

- Subsequently remove the 25 mm Al or 1.2 mm Cu prefilter.
- Collimate to the resolution test.
- Perform the resolution test for DR again without prefilter as above.

Tab. 12 Evaluation of resolution without prefiltering

| Operating mode   | I.I. format      | Setpoints<br>Resolution | Actual value<br>Resolution [LP/mm] |                 |
|--|------------------|-------------------------|------------------------------------|-----------------|
|  |                  |                         | Factory                            | Place of<br>use |
|  |                  | 23 cm I.I.              | Monitor 1                          | Monitor 1       |
| DR (1000W)<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid<br>Dose) | Full for-<br>mat | $\geq 1.6$ LP/mm        |                                    |                 |
| DR (1000W)<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid<br>Dose) | Zoom 1           | $\geq 2.0$ LP/mm        |                                    |                 |
| DR (1000W)<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid<br>Dose) | Zoom 2           | $\geq 2.5$ LP/mm        |                                    |                 |
| DR (1000W)<br>(General, All region,<br>SERVICE_Q_C_HC2, Mid<br>Dose) | Zoom 3           | $\geq 3.1$ LP/mm        |                                    |                 |



## Dynamic Test

|   |     |    |
|---|-----|----|
| SUBTRACTION option present:   | Yes | No |
| If no:  |     |    |
| The sections Capillary visibility test during subtraction, Capillary visibility test for roadmap, and Pixelshift function do not apply. |     |    |

### NOTE


**The dynamic test in conjunction with the plexi capillary test is used to detect small contrast differences.**

## Capillary visibility test during fluoroscopy

### Measurement setup

- Remove the 1.2 mm Cu precision X-ray filter from the beam path.
- Place the dynamic test without holder, with heart contour diaphragm and plexi capillary test on an X-ray-compatible table. The plexi capillaries are close to the I.I.

### Requirements

- Select full format.
- Select the "General, All region, SERVICE\_Q\_C\_HC2" exam set.
- Set the dose rate level to "High."
- Set a distance from the I.I. to the dynamic test that allows for the image field to be covered completely.
- Set noise reduction to high. (The LED in button 11 of the control console (heart button) does not light up.)
- Set edge enhancement to the lowest level (button: ).
- Select linear LUT (LUT\_Linear).

### Evaluation of the monitor image



- Switch radiation on and evaluate the live image during irradiation.
- Check off non-visible plexi capillaries in [\(Fig. 5 / p. 34\)](#) (from left to right 2L - 1 - 5R).

### Setpoints

- ➡ The plexi capillaries not identified in [\(1/Fig. 5 / p. 34\)](#) must be visible.



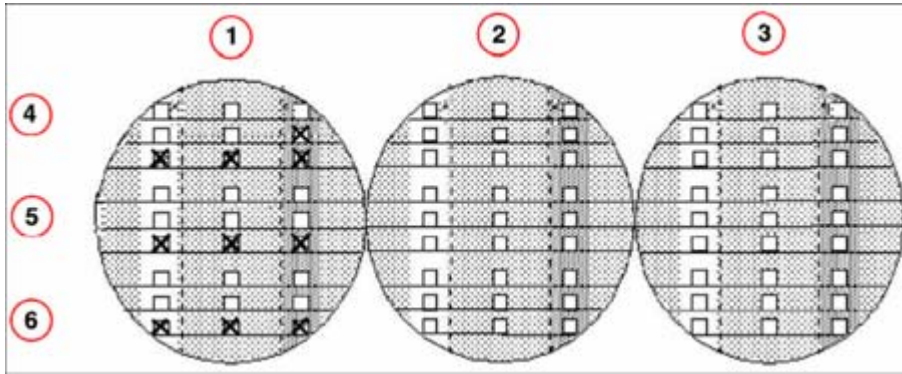


Fig. 5: Monitor image


|        |                   |
|--------|-------------------|
| Pos. 1 | Target value      |
| Pos. 2 | Factory           |
| Pos. 3 | Place of use      |
| Pos. 4 | Group - 3 mm wide |
| Pos. 5 | Group - 2 mm wide |
| Pos. 6 | Group - 1 mm wide |

## Capillary visibility test during subtraction

### Measurement setup

- Place the dynamic test without holder, with heart contour diaphragm and plexi capillary test on an X-ray-compatible table. The plexi capillaries are close to the I.I.
- Mechanically clamp the plexi capillary test so that the plexi capillaries can be moved by the rubber ball during the subtraction exposure.

### Requirements

- Select full format.
- Select the "General, All region, SERVICE\_Q\_C\_HC2" exam set.
- Set the dose rate level to "High."
- Set a distance from the I.I. to the dynamic test that allows for the image field to be covered completely.
- Select subtraction.
  - ⇒ SUB LUT 3MH is selected (pre-setting).
- Set edge enhancement to the lowest level (button: ).

### Trigger subtraction



- Switch radiation on.
  - ⇒ After 3 seconds of radiation, the mask is set automatically.
- Then cause the plexi capillary test to move by squeezing the rubber ball.
- After another 3 seconds, switch the radiation off.



## Evaluation of the capillary visibility

- Use the mouse in the scroll bar to scroll back in the viewing task card to where the white and black capillaries are best visible (2 to 3 images).

|             |  |
|-------------|--|
| <b>NOTE</b> | <b>For improved visibility,<br/>SUB LUT 4MH can also be selected as needed.</b>                  |
| <b>NOTE</b> | <b>Do not evaluate the first white line.<br/>Start the evaluation with the first black line.</b> |

- Check off non-visible black plexi capillaries in the "Subtraction, black lines" table (from left to right 2L - 1 - 5R).
- Check off non-visible white plexi capillaries in the "Subtraction, white lines" table (from left to right 2L - 1 - 5R).

## Setpoints

- The black plexi capillaries not identified in the "Setpoints" column of the "Subtraction, black lines" table must be visible.
- The white plexi capillaries not identified in the "Setpoints" column of the "Subtraction, white lines" table must be visible.

Tab. 13 Subtraction, black lines

|       | Setpoints |   |    | Factory |   |    | Place of use |   |    |        |
|-------|-----------|---|----|---------|---|----|--------------|---|----|--------|
|       | 2L        | 1 | 5R | 2L      | 1 | 5R | 2L           | 1 | 5R | Group  |
| Black |           |   |    |         |   |    |              |   |    | Top    |
| Black |           |   | X  |         |   |    |              |   |    | Group  |
| Black | X         | X | X  |         |   |    |              |   |    | 3 mm   |
| Black |           |   |    |         |   |    |              |   |    | Width  |
| Black |           |   |    |         |   |    |              |   |    | Middle |
| Black |           |   | X  |         |   |    |              |   |    | Group  |
| Black | X         | X | X  |         |   |    |              |   |    | 2 mm   |
| Black |           |   |    |         |   |    |              |   |    | Width  |
| Black |           |   |    |         |   |    |              |   |    | Bottom |
| Black |           |   | X  |         |   |    |              |   |    | Group  |
| Black | X         | X | X  |         |   |    |              |   |    | 1 mm   |
|       |           |   |    |         |   |    |              |   |    | Width  |



Tab. 14 Subtraction, white lines

|       | Setpoints |   |    | Factory |   |    | Place of use |   |    | Group                            |
|-------|-----------|---|----|---------|---|----|--------------|---|----|----------------------------------|
|       | 2L        | 1 | 5R | 2L      | 1 | 5R | 2L           | 1 | 5R |                                  |
| White |           |   |    |         |   |    |              |   |    | Top<br>Group<br>3 mm<br>Width    |
| White |           |   | X  |         |   |    |              |   |    |                                  |
| White | X         | X | X  |         |   |    |              |   |    |                                  |
| White |           |   |    |         |   |    |              |   |    | Middle<br>Group<br>2 mm<br>Width |
| White |           |   | X  |         |   |    |              |   |    |                                  |
| White | X         | X | X  |         |   |    |              |   |    |                                  |
| White |           |   |    |         |   |    |              |   |    | Bottom<br>Group<br>1 mm<br>Width |
| White |           |   | X  |         |   |    |              |   |    |                                  |
| White | X         | X | X  |         |   |    |              |   |    |                                  |

### Evaluation of visual brightness impression

- On monitor A, evaluate the white, 3 mm capillary line in fields 2L, 1 and 5R. There must not be any noticeable difference in brightness in the fields.

No noticeable difference in brightness

visible in fields 2L, 1 and 5R:

**Factory**

☐ Yes ☐ No

**Place of use**

☐ Yes ☐ No

## Capillary visibility test for roadmap


### Measurement setup

- Place the dynamic test without holder, with heart contour diaphragm and plexi capillary test on an X-ray-compatible table. The plexi capillaries are close to the I.I.
- Mechanically clamp the plexi capillary test so that the plexi capillaries can be moved by the rubber ball during the subtraction exposure.

### Requirements

- Select full format.
- Select the "General, All region, SERVICE\_Q\_C\_HC2" exam set.
- Set the dose rate level to "Mid."



- Set a distance from the I.I. to the dynamic test that allows for the image field to be covered completely.
- Select roadmap.
  - ⇒ SUB LUT 3MH is selected (pre-setting).
- Set edge enhancement to the lowest level (button: ).

## Start roadmap



- Switch radiation on (phase A).
  - ⇒ After 3 seconds of radiation, the mask is set automatically (phase B).
  - ⇒ Do **not** move the plexi capillary test (rubber ball).
- After another 3 seconds, switch the radiation off.



- Switch radiation on again (phase C).
  - ⇒ The LUT must have switched over to LUT Road 3 (pre-setting). If SUB LUT 3MH has correctly switched over to LUT Road 3, the image background changes from light to dark.
- Move the plexi capillary test by squeezing the rubber ball.
- Radiation remains switched on during the evaluation.

## Evaluation of the capillary visibility

- Radiation remains switched on during the evaluation.

### NOTE

**Do not evaluate the first white line.**

**Start the evaluation with the first black line.**

- Check off non-visible black plexi capillaries in the "Roadmap, black lines" table (from left to right 2L - 1 - 5R).
- Check off non-visible white plexi capillaries in the "Roadmap, white lines" table (from left to right 2L - 1 - 5R).
- After the capillary visibility is evaluated, switch radiation off.

## Setpoints

- ⇒ The black plexi capillaries not identified in the "Setpoints" column of the "Roadmap, black lines" table must be visible.
- ⇒ The white plexi capillaries not identified in the "Setpoints" column of the "Roadmap, white lines" table must be visible.



Tab. 15 Roadmap, black lines

|       | Setpoints |   |    | Factory |   |    | Place of use |   |    | Group                      |
|-------|-----------|---|----|---------|---|----|--------------|---|----|----------------------------|
|       | 2L        | 1 | 5R | 2L      | 1 | 5R | 2L           | 1 | 5R |                            |
| Black |           |   |    |         |   |    |              |   |    | Top Group<br>3 mm Width    |
| Black |           |   | X  |         |   |    |              |   |    |                            |
| Black | X         | X | X  |         |   |    |              |   |    |                            |
| Black |           |   |    |         |   |    |              |   |    | Middle Group<br>2 mm Width |
| Black |           |   | X  |         |   |    |              |   |    |                            |
| Black | X         | X | X  |         |   |    |              |   |    |                            |
| Black |           |   |    |         |   |    |              |   |    | Bottom Group<br>1 mm Width |
| Black |           |   | X  |         |   |    |              |   |    |                            |
| Black | X         | X | X  |         |   |    |              |   |    |                            |

Tab. 16 Roadmap, white lines

|       | Setpoints |   |    | Factory |   |    | Place of use |   |    | Group                      |
|-------|-----------|---|----|---------|---|----|--------------|---|----|----------------------------|
|       | 2L        | 1 | 5R | 2L      | 1 | 5R | 2L           | 1 | 5R |                            |
| White |           |   |    |         |   |    |              |   |    | Top Group<br>3 mm Width    |
| White |           |   | X  |         |   |    |              |   |    |                            |
| White | X         | X | X  |         |   |    |              |   |    |                            |
| White |           |   |    |         |   |    |              |   |    | Middle Group<br>2 mm Width |
| White |           |   | X  |         |   |    |              |   |    |                            |
| White | X         | X | X  |         |   |    |              |   |    |                            |
| White |           |   |    |         |   |    |              |   |    | Bottom Group<br>1 mm Width |
| White |           |   | X  |         |   |    |              |   |    |                            |
| White | X         | X | X  |         |   |    |              |   |    |                            |



## Evaluation of LUT change from phase B to phase C

- As described in the "Start roadmap" section, LUT Road 3 must automatically be selected when changing to phase C.

|  | Factory                      |                             | Place of use                 |                             |
|--|------------------------------|-----------------------------|------------------------------|-----------------------------|
| LUT changed when changing from phase B to phase C: | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

## Pixelshift function

### Requirements

The subtraction image from the roadmap test is present.

- Select the roadmap image in the Viewer.
- Select pixelshift in the SUB task card.

### Evaluation

- Using the arrow tool, move the mask successively in all directions:
  - ⇒ Apart from the black and white edge strips, no artifacts may occur.
- Using the Auto Pixelshift tool, select a location.
  - ⇒ In this location the shifted mask must return to artifact-free superimposition.

|                         | Factory                  |     |                          |    | Place of use             |     |                          |    |
|-------------------------|--------------------------|-----|--------------------------|----|--------------------------|-----|--------------------------|----|
| Pixelshift function OK? | <input type="checkbox"/> | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Yes | <input type="checkbox"/> | No |



## Edge enhancement, contrast enhancement, and object movements

### NOTE

Only perform edge enhancement, LUT selection change, and motion unsharpness at the factory.

## Edge enhancement

### Requirements

- Place the dynamic test without holder, with heart contour diaphragm and plexi capillary test, on the I.I. input screen. The plexi capillaries are close to the I.I.
- Select the "General, All region, SERVICE\_Q\_C\_HC2" exam set.
- Select medium dose level.
- Set edge enhancement to the lowest level.
- Release fluoroscopy briefly.



⇒ Use the LIH image to evaluate the edge enhancement.

### Evaluation of the monitor image

- Activate the button for selecting edge enhancement on the control console several times.
  - ⇒ The individual edge enhancement levels (20%, 40%, ...) are selected one after another.
- Evaluate the edge enhancement function.

|   | Factory                  |     |                          |    |
|---|--------------------------|-----|--------------------------|----|
| Function control of edge enhancement OK?<br>=> The bright-dark transitions are clearly visible when a higher percentage edge enhancement level is selected. | <input type="checkbox"/> | Yes | <input type="checkbox"/> | No |

## LUT selection change

### Requirements

- Place the dynamic test without holder, with heart contour diaphragm and plexi capillary test, on the I.I. input screen. The plexi capillaries are close to the I.I.
- Select the "General, All region, SERVICE\_Q\_C\_HC2" exam set.
- Select medium dose level.
- Set edge enhancement to the lowest level.





- Release fluoroscopy briefly.  
⇒ Use the LIH image to evaluate the LUT selection change.

## Evaluation of the monitor image

- Activate the LUT selection change button.  
⇒ The image contrast changes.
- Evaluate the LUT selection change function.

|   |                          |     |                          |    |
|---|--------------------------|-----|--------------------------|----|
|   | Factory                  |     |                          |    |
| LUT selection change function in order? | <input type="checkbox"/> | Yes | <input type="checkbox"/> | No |

## Motion unsharpness

|  |     |    |
|--|-----|----|
| DCM option present:<br>If no: Motion unsharpness section does not apply. | Yes | No |
|--|-----|----|

## Requirements

- Remove the dynamic test without holder, with heart contour diaphragm and plexi capillary test, from the I.I. input screen and place on a separate surface (e.g. table).
- Additionally, place a screwdriver in the center of the dynamic test.
- Position the C-arm with respect to the separate surface so that the dynamic test is over or under the I.I. input screen. The plexi capillaries are close to the I.I.

### NOTE

**If no suitable surface is available, the dynamic test with heart contour diaphragm and plexi capillary test can also be placed directly on the I.I. input screen.**

**An X-ray-absorbing object (e.g. long aluminum rod or the like) must be moved over the dynamic test in the beam path during radiation.**

**Pay attention to radiation protection!**

- Select the "General, All region, SERVICE\_Q\_C\_HC2" exam set.
- Select medium dose level.



## Evaluation of the monitor image

- Fluoroscopy on.
- Move the C-arm horizontally during fluoroscopy.  
⇒ A smearing effect is clearly visible on the image during movement of the C-arm with respect to the capillary test.
- Radiation off.
- Select the DCM operating mode.





- The "General, All region, SERVICE\_Q\_C\_HC2" exam set is selected.
- Select medium dose level.
- Select the maximum pulse frequency.
- Radiation (DCM) on.
- Move the C-arm horizontally during DCM.
  - ⇒ The object is depicted in sharp focus but in multiple images when the C-arm is moved with respect to the capillary test.
- Radiation off.
- Evaluate the motion unsharpness test.
- Remove the screwdriver that was placed there before.

|                       | Factory                  |     |                          |    |
|-----------------------|--------------------------|-----|--------------------------|----|
| FL, DCM functions OK? | <input type="checkbox"/> | Yes | <input type="checkbox"/> | No |

Comments

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**NOTE**

**Perform only in the factory.**

The following controls are active for the specified prefiltering.

|  |   |
|--|---|
| Automatic dose rate control (ADR)          | with approximately 9 to 11 mm Cu and dynamic test in the beam path  |
| Automatic TV iris collimator control (AIR) | with approximately 11 to 13 mm Cu and dynamic test in the beam path |

The test is used to test the functioning of these controls.

## Requirements

- Both monitors must be set to give approximately the same brightness and contrast impression (synchronism) (LUT, brightness and contrast setting).

## Preparations

- Attach the dynamic test without holder and plexi capillary test, but with heart contour diaphragm, to the I.I.:
- Select the "General, All region, SERVICE\_Q\_HC2" exam set.
- Select medium dose level.
- Select the fluoro operating mode.
- Switch the I.I. to full format.
- Completely open the collimator.
- Prefilter with Cu until 120 kV to 124 kV are displayed. To do this, switch on fluoroscopy briefly (approx. 9 mm to 11 mm Cu necessary).

⇒ Automatic dose rate control (ADR) is active.



- Radiation on.
- Select linear contrast LUT. (LUT\_Linear)
- Evaluate the brightness of the fluoroscopy image.
- Radiation off.
- Save the LIH image and display it on the reference monitor.

## TV iris collimator control



- Additionally, attach 2.1 mm Cu to the radiation exit.
- Radiation on.
  - ⇒ Generator limit 125 kV/4.3 mA must be reached.
  - ⇒ The automatic TV iris collimator control (AIR) is active.
- Select linear contrast LUT. (LUT\_Linear)
- Evaluate the brightness of the fluoroscopy image.
- Radiation off.
- Save the LIH image.



- Display both images on both monitors.
  - ⇒ Display the image saved during active ADR on the right monitor.
  - ⇒ Display the image saved during active AIR on the left monitor.
  - ⇒ Both images are displayed with the linear LUT (LUT\_Linear).
- Evaluate the brightness impression of the fluoroscopic image generated during active AIR and compare it to that of the reference image generated during active ADR.
  - ⇒ The brightness impression should be approximately the same.

**Evaluation****Factory**

Same brightness impression?

☐ Yes☐ No



## Digital preprocessing

**NOTE**

**Perform only in the factory.**

**Exception: Also perform a check after replacing the image intensifier.**

## Vignetting compensation

**Requirements**

- Attach a 2.1 mm Cu prefilter close to the tube.
- Set the monitor contrast to linear.

**Test sequence**

- Select the "General, All region, SERVICE\_Q\_C\_HC2" exam set.
- Select medium dose level.
- Release fluoroscopy for approx. 10 seconds and save the image using the ATB button.
- Select local service (menu: <Options>-<Service>-<Local Service>).
  - ⇒ When the local service window is open and the measurement function is selected in the Viewing task card, the corresponding brightness value (min/max/mean/SD) can be displayed by selecting an image region with the mouse.
- Minimize the local service window or move it to the right monitor.
- Select the previously saved image in the viewer.
- In the Tools menu bar of the imaging system, select **Measure ---> Rectangle** ↵.
- Select the 5 fields according to the "measuring field" image. To do this, place the mouse pointer on a corner of the field to be measured and select the field according to the "display values" image while pressing the left mouse button.
  - ⇒ The brightness data is displayed for every marked field.
- Read off the average brightness value (mean) for every field.
  - ⇒ Divide the average (mean) of each of the fields at the edge by the average (mean) of the middle field and then multiply each result by 100 (brightness outside to brightness middle (in %) -->  $(\text{Mean X} / (\text{Mean 1} / 100))$ ).
- Evaluate the vignetting compensation function.
  - ⇒ The values calculated should be in the range of 80% to 120%.



## Evaluation

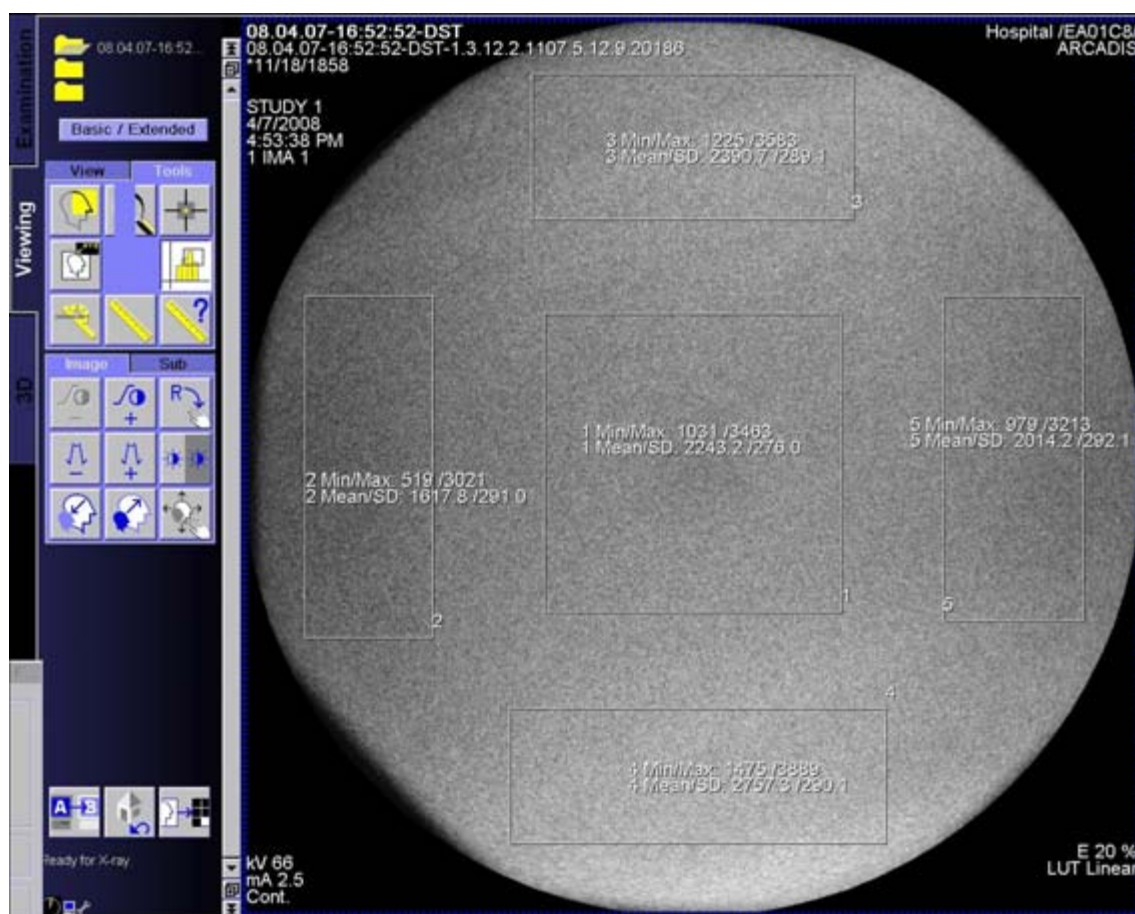


Fig. 6: VC10A\_VignMeas2

|                  | Center<br>scan field | Left<br>measurement<br>field [%] | Right<br>measurement<br>field [%] | Upper<br>measurement<br>field [%] | Lower<br>measure-<br>ment field<br>[%] |
|------------------|----------------------|----------------------------------|-----------------------------------|-----------------------------------|--|
| Brightness value | _____                | _____                            | _____                             | _____                             | _____                                  |
| Brightness in %  | n.a.                 | _____                            | _____                             | _____                             | _____                                  |

- Evaluate the vignetting compensation function.
  - ⇒ The values calculated should be in the range of 80% to 120%.
  - ⇒ Correct the vignetting compensation if necessary.

**Procedure for correcting the setting of the vignetting compensation:**

- Log in to Service Software.
- Click on "MainSystem" and "Next."
- Click on "Image Intensifier."



- Enter the new value in the "Vignetting" field and confirm with the Enter key.
  - Standard vignetting compensation = "2"
  - For calculated values "< 80%" increase the value by one step.
  - For calculated values "> 120%" decrease the value by one step.
  - For a calculated lowest value of "< 80%", measured in one of the outer measurement fields, but when the simultaneously calculated highest value is ">120%" in another one of the outer measurement fields, program the vignetting compensation in such a way that the degree by which the brightness exceeds and falls short of the average brightness lies more or less symmetrically around 100%.
- Click on "Save" and confirm.
  - ⇒ The Main System will automatically be restarted.
- Perform the "Vignetting compensation" test again.

## Result

- If the vignetting compensation was adjusted:
  - ⇒ Setting modified from: \_\_\_\_\_ to: \_\_\_\_\_

|                             |                                 |     |                             |
|-----------------------------|---------------------------------|-----|-----------------------------|
|                             | Factory or after replacing I.I. |     |                             |
| Vignetting compensation OK? | <input type="checkbox"/>        | Yes | <input type="checkbox"/> No |



## Image Disturbances (artifacts)

- Check off all image disturbances found during settings and IQ tests in the table in the IQ Test Certificate.
- If image disturbances are detected that are not listed in the table, describe them under "Other disturbances."
- Three assessment numbers indicating the extent of the disturbance are provided for each assessment of the relevant disturbance.

### Definition of the assessment numbers

- 1 = No disturbances and artifacts were detected during startup.
- 2 = Minor disturbances, artifacts occurred sporadically during startup. The cause could not be localized and the "error" could not be corrected. The disturbances scarcely affect the good overall image impression, and the ability to make a medical diagnosis from the images is not impaired in any way. Therefore, the artifacts are tolerable.
- 3 = During start-up, more frequent or stronger disturbances/artifacts occurred that disturb the overall impression of the image or impair the ability of the images to be diagnosed medically and are therefore no longer tolerable. The system must not be shipped or handed over to the operator in this condition.



## Description of the artifacts

- **Hum:**

Inconsistencies resulting from electromagnetic interference in the imaging systems are unattractive and disturbing. Depending on the nature of the disturbance, they can considerably impair the ability of the images to be evaluated and should ideally not occur at all. They are tolerable only to a very slight degree. Hum disturbances are visible as sporadic, horizontal light-dark patterns in the image; they are temporary and are not limited to a specific location.
- **Streaking:**

Very high-frequency electromagnetic radiation is visible in the image as light or dark, sometimes very short, horizontal lines (temporary). Interference stripes that are caused by dirt on optically effective surfaces must also be recorded here. They are limited to a specific location and are not temporary. Streaks are barely tolerable.
- **Ghost images:**

These are object contours that are usually offset to one side and appear double. They are caused by reflections in poorly adapted, long video cables. Clearly visible ghost images are not tolerable.
- **Background structures** are permanent, grid-shaped patterns, primarily in dark image sections, that are also called "fixed noise."
- **Pixel errors** are image pixels without image information. They are visible on the monitor as dark or light pixel-size dots. There are tolerable and intolerable pixel errors. The TV camera is inspected very precisely in the test area for pixel errors and only TV cameras with pixel errors corresponding to an internal specification according to type and number are provided to customers. These tolerable pixel errors must be documented in the IQ measuring protocol.



## Evaluation of the image disturbances

Setpoint for assessment of the disturbance: Only 1 and 2 are allowed.

|                                     | Factory                          |   |   | Place of use                     |   |   |
|-------------------------------------|----------------------------------|---|---|----------------------------------|---|---|
| Nature of the disturbance, artifact | Assessment of the disturbance *1 |   |   | Assessment of the disturbance *1 |   |   |
|                                     | 1                                | 2 | 3 | 1                                | 2 | 3 |
| Hum                                 |                                  |   |   |                                  |   |   |
| Interference stripes                |                                  |   |   |                                  |   |   |
| Ghost images (reflections)          |                                  |   |   |                                  |   |   |
| Background structures               |                                  |   |   |                                  |   |   |
| Pixel errors *2                     |                                  |   |   |                                  |   |   |

Other interference:

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Comments:

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Note: Image disturbance assessments must be recorded at the place of use.

**\*1** Assessment of the disturbances

- 1 = No disturbances, artifacts
- 2 = Slight disturbances, artifacts
- 3 = Intolerable disturbances, artifacts

**\*2** State the number and position of pixel errors under comments.



## Local Printer - Sony UPD970/UPD990

**NOTE**

If a hardcopy camera is to be connected, see “General Hard-copy Information,” SPR2-310.814.25... (CB-DOC).

|   |                              |                             |
|---|------------------------------|-----------------------------|
| Local printer available? If yes: camera type<br>.....<br>If no: chapter not applicable. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
|---|------------------------------|-----------------------------|

## Function Check

**NOTE**

The Analog/Digital switch on printer UPD 970/990 must be set to “Digital.”

- The local printer must be connected and ready to operate.
- Open local service so that the service patient is displayed in the Patient Browser.

**Requirements**

- Select the service patient in the browser, load the SMPTE test image in the Viewer, and print it on the local printer.

**Evaluation**

- The 5% and 95% fields on the printed SMPTE test image should still be discernible.
  - ➡ If necessary, adjust the brightness/contrast using the control dials at the front of the printer, and repeat the test.

|          |                              |                             |
|----------|------------------------------|-----------------------------|
|          | Place of use                 |                             |
| Test OK? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

Remarks:

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## Customer-specific organ programs (exam sets)

### NOTE

Only at the place of use, only after changes to the organ programs (examination sets) as requested by the customer

No organ programs were changed during start-up. If "yes," do not perform the check of the newly programmed ADR control characteristics.

☐ Yes ☐ No

Date

Signature

\_\_\_\_\_

## Checking newly programmed ADR control characteristics

### NOTE

The ADR control characteristics programmed by default were already checked in the "Checking the ADR control characteristics" section.

### NOTE

The check of newly programmed ADR control characteristics facilitates testing of the ADR control characteristics during subsequent maintenance work.

During start-up, the determined values are entered in the "Setpoints" column of the "Changed organ programs" table.

During later checks, the determined values are entered in the "Actual values" column.

As a result, a comparison of the start-up values and the subsequently determined values is ensured.

### Preparations

- Select fluoroscopy.
- Attach a 2.1 mm Cu precision X-ray filter for prefiltering in the area of the radiation outlet.
- Select the organ program (exam set) with the changed ADR control characteristic.
- Enter the name of the organ program (exam set) with the changed ADR control characteristic in the "Organ program" column of the "Changed organ programs" table.
- Enter the name of the programmed ADR control characteristic in the "ADR control characteristic" column of the "Changed organ program" table. Use the name specified in the operating instructions.



## Evaluation

- Leave the programmed dose rate level and enter it in the "Dose level" column of the "Changed organ programs" table.
- Radiation on.
- Read off the kV and mA values displayed on the control panel during start-up and enter them in the "Setpoints" column of the "Changed organ programs" table.
- Read off the kV and mA values displayed on the control panel during subsequent checks and enter them in the "Actual values" column of the "Changed organ programs" table.
- If additional organ programs with changed control characteristics are programmed, repeat the above-described procedure.
- Enter n.a. in all unused table rows.

Tab. 17 Changed organ programs

| Organ program | ADR control curve | Dose level | Setpoints (Start-up) |    | Actual values (Maintenance) |    |
|---------------|-------------------|------------|----------------------|----|-----------------------------|----|
|               |                   |            | kV                   | mA | kV                          | mA |
| n.a.          | n.a.              | n.a.       |                      |    |                             |    |
|               |                   |            |                      |    |                             |    |
|               |                   |            |                      |    |                             |    |
|               |                   |            |                      |    |                             |    |
|               |                   |            |                      |    |                             |    |
|               |                   |            |                      |    |                             |    |
|               |                   |            |                      |    |                             |    |
|               |                   |            |                      |    |                             |    |
|               |                   |            |                      |    |                             |    |
|               |                   |            |                      |    |                             |    |
|               |                   |            |                      |    |                             |    |



## Protective conductor test

- The image quality quick test can normally be performed without opening the covers. The protective conductor test is not necessary.
- However, if the ARCADIS Avantic covers were removed, the protective conductor test must be performed according to ARTD-002.731.17....



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**Danger of injury, death, or material damage.**

**Non-compliance can lead to death, injury, or material damage.**

**Please note:**

- ⇒ **The product-specific safety information in the start-up instructions and system service documentation,**
  - ⇒ **The general safety information in TD00-000.860.01..., and**
  - ⇒ **The safety information in accordance with ARTD Part 2.**
-



|                               |  |
|-------------------------------|--|
| Monitors chapter              | Target value for brightness for b/w monitor corrected to 400 cd/m <sup>2</sup> . |
| Digital preprocessing chapter | Description of vignetting compensation revised.                                  |



